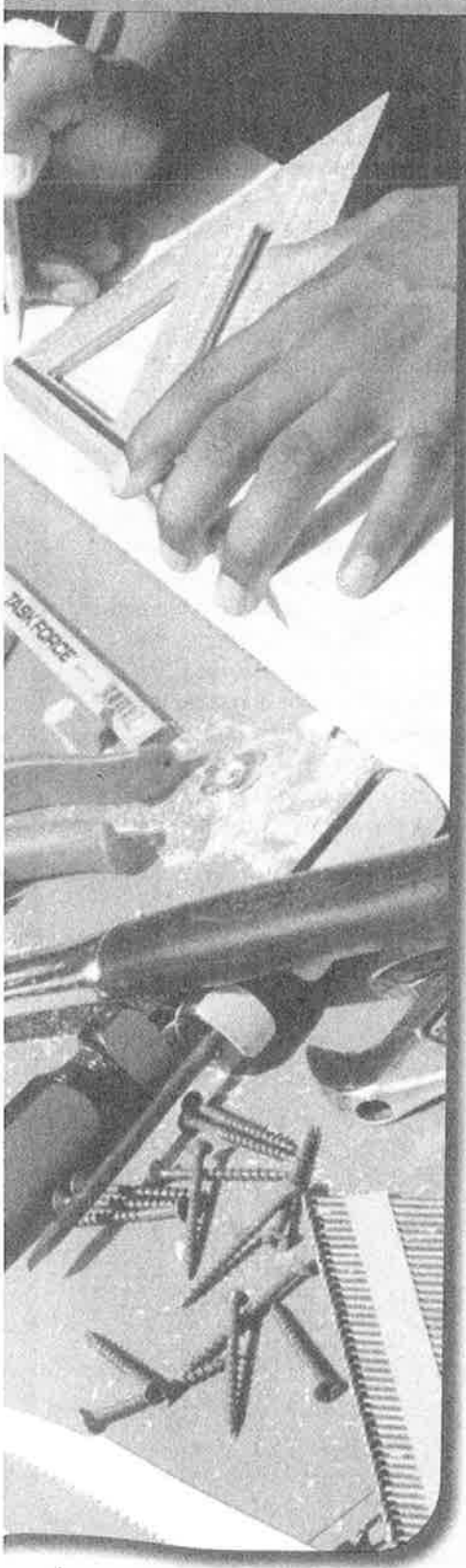
# Chapter 1 Organization of the Industry



**OBJECTIVES**

After completing this chapter, the student should be able to:

- list and describe several potential careers in construction.
- explain the roles of architects, engineers, city building officials, and contractors.
- describe the major forms of business ownership and the differences between them.
- explain what a building code is.

## Glossary of Terms

**apprentice** a person who is being trained to work in the building trades. Apprentices attend classes and work under the supervision of a skilled craftsman.

**contractor** the person who owns the construction business. Contractors enter into contracts with customers to do specified construction work. Contractors hire workers or other subcontractors to complete the contracted work.

**corporation** a form of business ownership in which people who are not involved in operating the business own shares of the company. The company is operated by a board of directors.

**craft** see skilled trades.

**craft union** members of a particular craft who are organized to work for the betterment of all members of the group. Union members pay dues as a requirement of their membership.

**developer** the person or company that buys undeveloped land and works with architects and contractors to develop it into more valuable property.

**journeyman** a skilled craft worker who has completed an apprenticeship or otherwise proved his or her ability in the trade.

**laborer** an unskilled or semiskilled worker on a construction site.

**model code** a suggested building code, intended to be adopted as is or with revisions to become an official code of a particular government.

**partnership** a form of business in which more than one person shares the ownership and operating duties for a company.

**profession** an occupation that requires more than four years of college and a license to practice.

**semiskilled labor** workers with very limited training or skills in the construction trades.

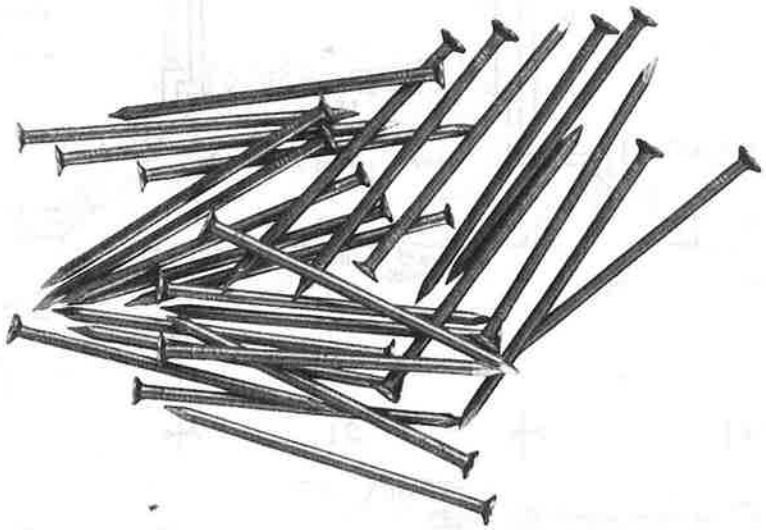
**skilled trades** the building trades—carpenters, electricians, plumbers, painters, and so on. These occupations require training and skill. The skilled trades are often referred to as the crafts.

**sole proprietorship** a business whose owner and operator are the same person.

**subcontractor** a contractor who is performing work for another contractor.

**technicians** technicians provide a link between the skilled trades and the professions by using mathematics, computer skills, specialized equipment, and knowledge of construction.

**unskilled labor** workers with no specific training in the construction trades. This term also applies to work that does not require training.



The residential construction industry is one of the biggest sectors of the American economy. According to *Engineering News Record,* a major construction news publication, one out of every six people is involved in construction in some way. The Home Builder's Institute reports that home building accounts for 52 percent of the construction industry. There are opportunities for people to work at all levels in the construction industry, from those who handle the tools and materials on the job site to the senior engineers and architects who spend most of their time in offices. Few people spend their entire lives in a single occupation, and even fewer spend their lives working for one employer. You should be aware of all the opportunities in the construction industry so that you can make career decisions in the future, even if you are sure of what you want to do at this time.

## Construction Personnel

The occupations in the construction industry can be divided into four categories:

- unskilled or semiskilled labor
- skilled trades or crafts
- technicians
- design and management

### Unskilled or Semiskilled Labor

Construction is labor intensive. That means it requires a lot of labor to produce the same dollar value of end products by comparison with other industries, where labor may be a smaller part of the picture. Construction workers with limited skills are called laborers. Laborers are sometimes assigned the tasks of moving materials, running errands, and working under the close supervision of a skilled worker. Their work is strenuous, and so construction laborers must be in excellent physical condition.

Construction laborers are construction workers who have not reached a high level of skill in a particular trade and are not registered in an apprenticeship program. These laborers often specialize in working with a particular trade, such as mason's tenders or carpenter's helpers (Fig. 1–1). Although the mason's tender may not have the skill of a bricklayer, the mason's tender knows how to mix mortar for particular conditions, can erect scaffolding, and is familiar with the bricklayer's tools. Many laborers go on to acquire skills and become skilled workers. Laborers who specialize in a particular trade are often paid slightly more than completely unskilled laborers.

### Skilled Trades

A craft or skilled trade is an occupation working with tools and materials and building structures. The building trades are the crafts that deal most directly with building construction (Fig. 1–2).

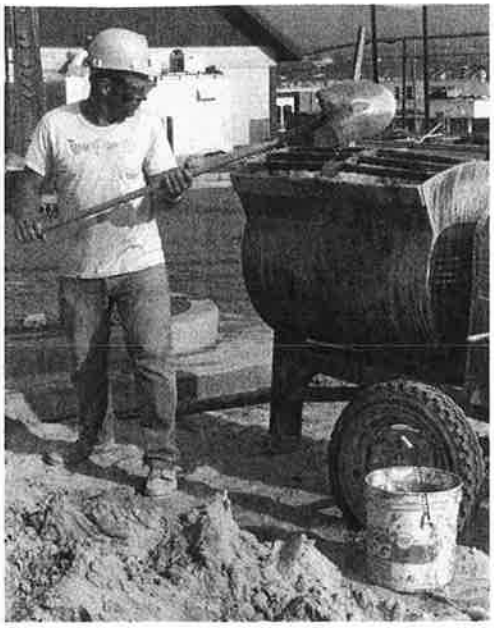


Figure 1–1 **This construction laborer is a mason's tender.**

| |
|---|
| Carpenter |
| Framing carpenter |
| Finish carpenter |
| Cabinetmaker |
| Plumber |
| New construction |
| Maintenance and repair |
| Roofer |
| Electrician |
| Construction electrician |
| Maintenance electrician |
| Mason |
| Bricklayer (also lays concrete blocks) |
| Cement finisher |
| HVAC technician |
| Plasterer |
| Finish plaster |
| Stucco plaster |
| Tile setter |
| Equipment operator |
| Drywall installer |
| Installer |
| Taper |
| Painter |

Figure 1–2 **Building trades.**

The skill needed to be employed in the building trades is often learned in an apprentice program. Apprenticeships are usually offered by trade unions, trade associations, technical colleges, and large employers. Apprentices attend class a few hours a week to learn the necessary theory. The rest of the

week they work on a job site under the supervision of a journeyman (a skilled worker who has completed the apprenticeship and has experience on the job). The term "journeyman" has been used for decades and probably will continue to be used for many more decades, but it is worth noting that many highly skilled building trades workers are women. Apprentices receive a much lower salary than journeymen, often about 50 percent of what a journeyman receives. The apprentice wage usually increases as stages of the apprenticeship are successfully completed. By the time the apprenticeship is completed, the apprentice can be earning as much as 95 percent of what a journeyman earns. Many apprentices receive college credit for their training. Some journeymen receive their training through school or community college and on-the-job training. In one way or another, some classroom training and some on-the-job supervised experience are usually necessary to reach journeyman status. Not all apprentice programs are the same, but a typical apprenticeship lasts 4 or 5 years and requires 144 hours per year of classroom training and 2,000 hours per year of supervised work experience.

The building trades are among the highest paying of all skilled occupations. However, work in the building trades can involve working in cold conditions in winter or blistering sun in the summer. Also, job opportunities will be best in an area where a lot of construction is being done. This should not be much of a threat to a person interested in a career in the trades. The construction industry is growing at a high rate nationwide. Generally plenty of work is available to provide a comfortable living for a good worker.

## Technicians

Technicians provide a link between the skilled trades and the professions. Technicians often work in offices, but their work also takes them to construction sites. Technicians use mathematics, computer skills, specialized equipment, and knowledge of construction to perform a variety of jobs. Figure 1–3 lists several technical occupations.

Most technicians have some type of college education, often combined with on-the-job experience, to prepare them for their technical jobs. Community colleges often have programs aimed at preparing people to work at the technician level in construction. Some community college programs are intended especially for preparing workers for the building trades, while others have more of a construction management focus. Construction management courses, such as those listed in Figure 1–4 give the graduate a good overview of the business of construction. The starting salary for a construction technician is about the same as for a skilled trade, but the technician can be more certain of regular work and will have better opportunities for advancement.

| Technical Career | Some Common Jobs |
|---|---|
| Surveyor | Measures land, draws maps, lays out building lines, and lays out roadways |
| Estimator | Calculates time and materials necessary for project |
| Drafter | Draws plans and construction details in conjunction with architects and engineers |
| Expeditor | Ensures that labor and materials are scheduled properly |
| Superintendent | Supervises all activities at one or more job sites |
| Inspector | Inspects project for compliance with local building codes at various stages of completion |
| Planner | Plans for best land and community development |

Figure 1–3 **Technicians.**

## Design and Management

Architecture, engineering, and contracting are the design and management professions. The professions are those occupations that require more than four years of college and a license to practice. Many contractors have less than four years of college, but they often operate at a very high level of business, influencing millions of dollars, and so they are included with the professions here. These construction professionals spend most of their time in offices and are not frequently seen on the job site.

Architects usually have a strong background in art, so they are well prepared to design attractive, functional buildings. A typical architect's education includes a four-year degree in fine art, followed by a master's degree in architecture. Most of their construction education comes during the final years of work on the architecture degree.

Engineers generally have more background in math and science, so they are prepared to analyze conditions and calculate structural characteristics. There are many specialties within engineering, but civil engineers are the ones most commonly found in construction. Some civil engineers work mostly in road layout and building. Other civil engineers work mostly with structures in buildings. They are sometimes referred to as structural engineers.

Contractors are the owners of the businesses that do most of the building. In larger construction firms, the principal (the owner) may be more concerned with running the business than with supervising construction. Some contractors are referred to as general contractors and others as subcontractors (Fig. 1–5). The general contractor is the principal construction company hired by the owner to construct the building. A general contractor might have only a skeleton crew, relying on subcontractors for most of the actual construction. The general contractor's superintendent coordinates the work of all the subcontractors.

| First Year<br>First Semester<br>Course # | Title | Credit Hrs. |
|---|---|---|
| FORM 101 | College Forum | 1 |
| CIVL 114 | Construction Materials | 2 |
| CNST 100 | Construction Surveying | 3 |
| CNST 170 | Blueprint Reading | 2 |
| ENGL 101 | English Composition I | 3 |
| MATH 150 | College Algebra & Trigonometry | 4 |
| | Humanities or Social Science Elective | 3 |
| | **Semester Total** | **18** |
| **Second Semester**<br>**Course #** | **Title** | **Credit Hrs.** |
| CNST 110 | Statics and Strength of Materials | 3 |
| CNST 120 | Architectural Drawing I | 2 |
| CNST 130 | Principles and Practices of Light Construction | 3 |
| ENGL 106 | English Composition II: Writing for Technicians | 3 |
| ACTG 100 | Applied Accounting | 3 |
| MATH 151 | Analytic Geometry & Basic Calculus | 4 |
| | **Semester Total** | **18** |
| **Second Year**<br>**First Semester**<br>**Course #** | **Title** | **Credit Hrs.** |
| CNST 230 | Construction Management Sem. | 3 |
| CNST 270 | Soils in Construction | 3 |
| CNST 220 | Architectural Drawing II | 3 |
| CNST 210 | Steel Construction | 3 |
| CNST 102 | Construction Estimating | 3 |
| PHYS 115 | Physics | 4 |
| | **Semester Total** | **19** |
| **Second Semester**<br>**Course #** | **Title** | **Credit Hrs.** |
| CNST 231 | Building Service Systems | 3 |
| CNST 211 | Concrete Construction | 3 |
| CNST 232 | Site Development | 3 |
| CNST 202 | Construction Planning & Control | 3 |
| CNST 239 | Construction Capstone | 3 |
| | **Semester Total** | **15** |
| | **Total Credits Required** | **70** |

Figure 1-4 **Construction management program at a community college.**

It is quite common for a successful journeyman to start his or her own business as a contractor, specializing in the field in which he or she was a journeyman. These are the subcontractors that sign on to do a specific part of the construction, such as framing or plumbing. As the contractor's company grows and the company works on several projects at one time, the skilled workers with the best ability to lead others may become foremen. A foreman is a working supervisor of a small crew of workers in a specific trade. All contractors have to be concerned with business management. For this reason, many successful contractors attend college and get a degree in construction management. Most states require contractors to have a license to do contracting in their state. Requirements vary from state to state, but a contractor's license usually requires several years of experience in the trade and a test on both trade information and the contracting business.

## An Overall View of Design and Construction

To understand the relationships between some of the design and construction occupations, we shall look at a typical housing development. The first people to be involved are the community planners and the real estate **developer.** The real estate developer has identified a 300-acre tract on which he would like to build nearly 1,000 homes, which he will later sell at a good profit. The developer must work with the city planners to ensure that the use he has planned is acceptable to the city. The city planner is responsible for ensuring that all building in the city fits the city's development plan and zoning ordinances. On a project this big, the developer might even bring in a planner of his own to help decide where parks and community buildings should be located and how much parking space they will need.

As the plans for development begin to take shape, it becomes necessary to plan streets and to start designing houses to be built throughout the development. A civil engineer is hired to plan and design the streets. The civil engineer will first work with the developer and planners to lay out the locations of the streets, their widths, and drainage provisions to get rid of storm water. (Did you ever consider how much water falls on a 1-mile-long by 32-foot-wide street when an inch of rain falls? More than 105,000 gallons! Where does that water go?) The civil engineer also considers soil conditions and expected traffic to design the foundation for the roadway.

An architectural firm, or perhaps a single architect, will design the houses. Typically several stock plans are used throughout a development, but many homeowners wish to pay extra to have a custom home designed and built. In a custom home, everything is designed for that particular house. Usually the homeowner, who will eventually live in the house, works with the architect to specify the sizes, shapes, and locations of rooms, interior and exterior trim, type of roof, built-in cabinets and appliances, use of outdoor spaces, and other special features. Architects specialize in use of space, aesthetics (attractive appearance), and livability features. Most architectural features do not involve special structural considerations, but when they do, a structural engineer is employed to analyze the structural requirements

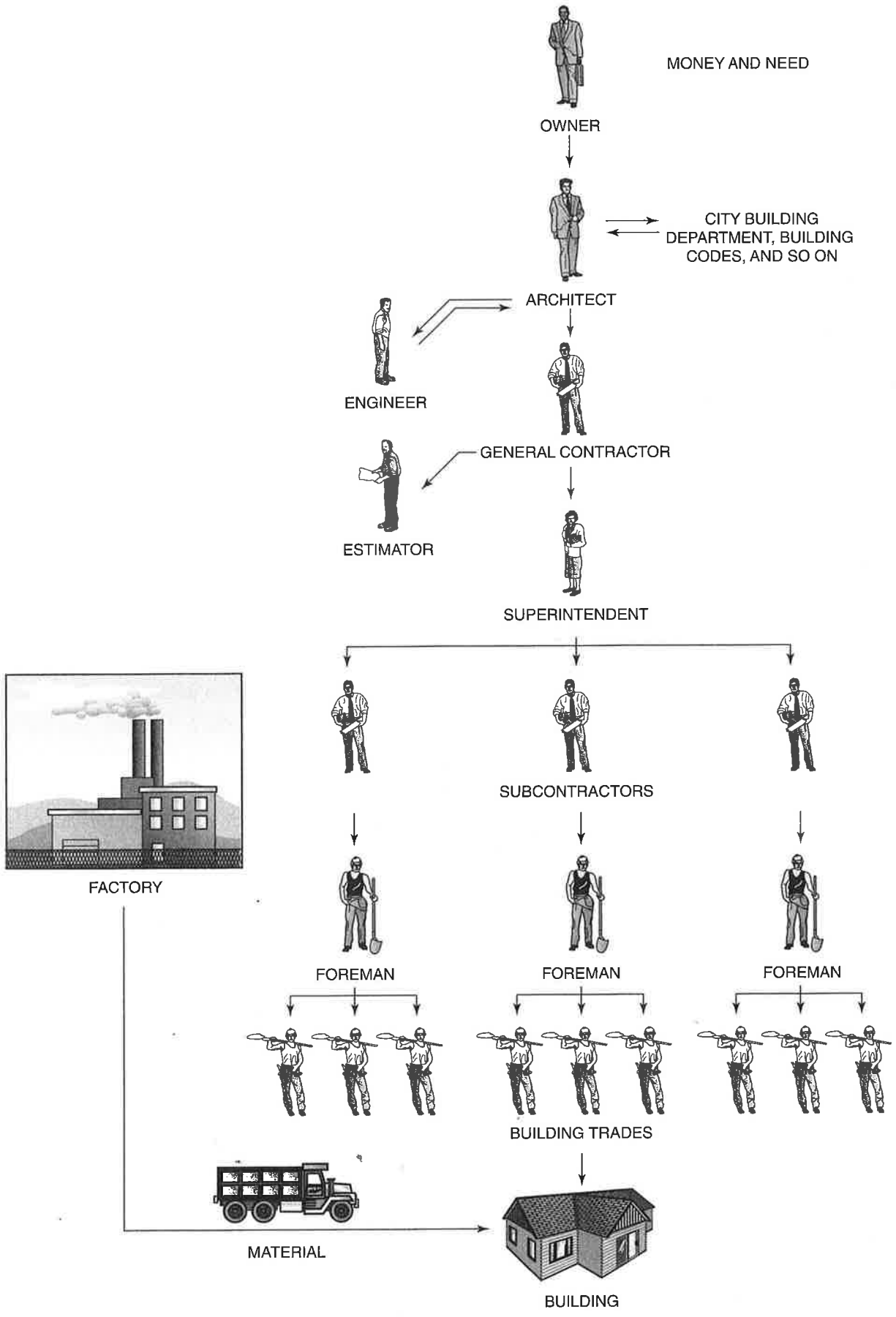



Figure 1–5 **Organization of the construction industry.**

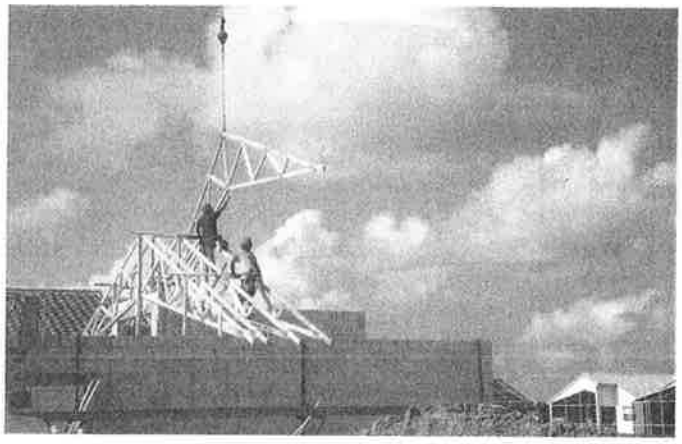


Figure 1–6 **Trusses are designed by engineers.**

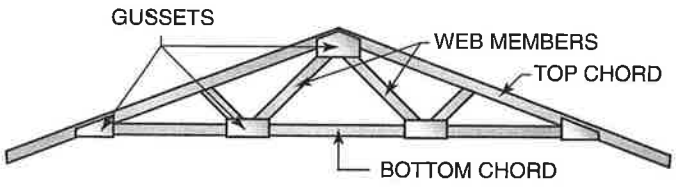



Figure 1–7 **Parts of a roof truss.**

and help ensure that the structure will adequately support the architectural features.

One part of construction that almost always involves an engineer is the design of roof trusses. Roof trusses are the assemblies that make up the frame of the roof (Fig. 1–6). Trusses are made up of the top chords, bottom chords, web members, and gussets (Fig. 1–7). The engineer considers the weight of the framing materials, the weight of the roof covering, the anticipated weight of any snow that will fall on the roof in winter, and the span (the distance between supports) of the truss to design trusses for a particular purpose. The architect usually hires the engineer for this work, and so the end product is one set of construction drawings that includes all the architectural and engineering specifications for the building. Even though the drawings are sometimes referred to as architectural drawings, they include work done by architects, engineers, and their technicians. Building codes require an architect's seal on the drawings before work can begin. The architect will require an engineer to certify certain aspects of the drawings before putting the architect's seal on them.

# Forms of Ownership

Construction companies vary in size from small, one-person companies to very large international organizations that do many kinds of construction. However, the size of the company does not necessarily indicate the form of ownership.

## Sole Proprietorship

The **sole proprietorship** is the easiest form of ownership to understand. The two words in the name of this form clearly describe it. Sole means only one or single. The proprietor of a business is the owner and operator. So a sole proprietorship is a business whose owner and operator are the same person. Sole proprietor construction companies are usually small companies in which the owner is one of the main workers.

Entrepreneurs are often sole proprietors. An entrepreneur is someone who starts a small business, often taking considerable financial risk. Small entrepreneurs started many of the largest, most successful businesses in the world today. The keys to successful entrepreneurship are understanding (not necessarily eliminating) the risks and doing thorough planning.

Each form of business ownership has advantages and disadvantages. The advantages of the sole proprietorship are that the owner has complete control over the business and that there is a minimum of government regulation. If the company is successful, the owner receives high profits. However, if the business goes into debt, the owner is responsible for that debt. The owner can be sued for the company, and the owner suffers all the losses of the company.

## Partnership

A **partnership** is similar to a sole proprietorship, but there are two or more owners, rather than just one. In a general partnership, each partner shares the profits and losses of the company in proportion to the partner's share of investment in the company. General partnerships are common among engineering and architectural companies where each partner is an expert in a different specialty.

In a general partnership, each partner can be held responsible for all the debts of the company. The advantage of this form of ownership is that the partners share the expense of starting the business. Also partnerships, like sole proprietorships, are not controlled by extensive government regulations.

A variation of the general partnership is the limited liability partnership (LLP). A limited liability partner is one who invests in the business, receives a proportional share of the profit or loss, but has limited liability. In other words, a limited liability partner can only lose his or her investment. Every LLP must have one or more general partners who run the business. The general partners in an LLP have unlimited liability. They can be personally sued for any debts of the company.

## Corporation

In a **corporation** a group of people own the company. Another, usually smaller, group of people manage the business.

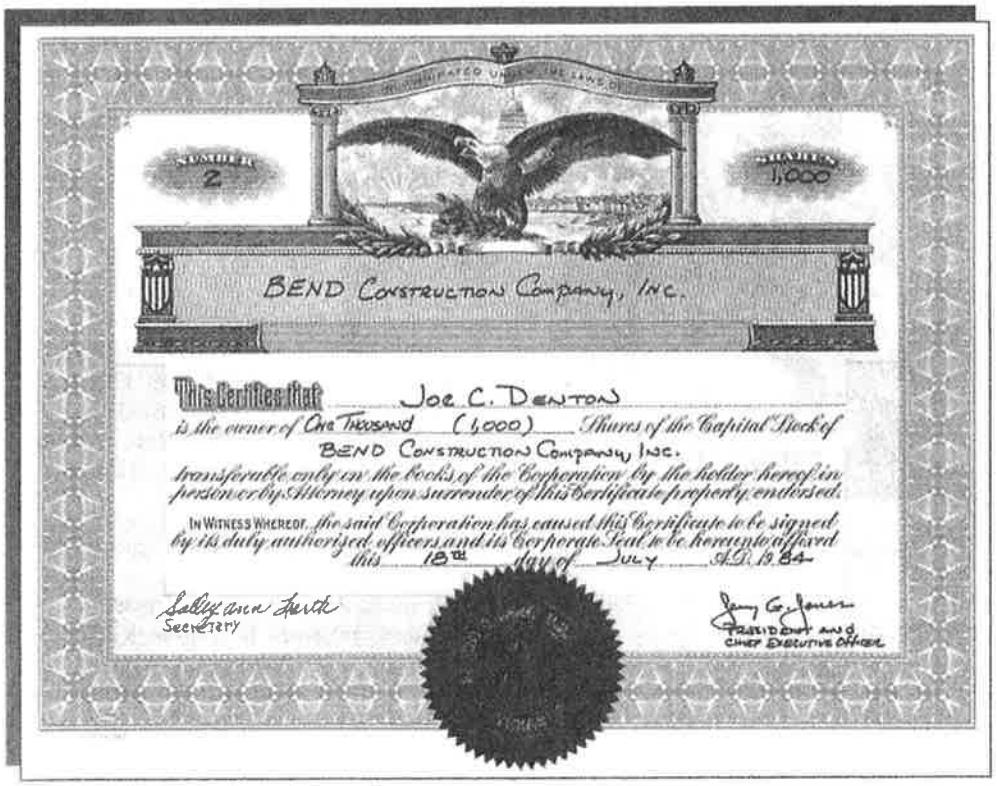



Figure 1-8 **Owners of corporations have shares of stock in the corporation.**

The owners buy shares of stock (Fig. 1–8). A share of stock is a share or a part of the business. The value of each share increases or decreases according to the success of the company. The stocks of many large corporations are bought and sold (traded) in public stock exchanges. Anybody can buy one or more shares of publicly traded stock and be a part owner of that business. Most small corporations and many large corporations are privately held. A privately held corporation is one in which stock is owned only by a select group of investors. Privately held stock cannot be bought and sold through public stock exchanges.

A corporation is managed by its board of directors (Fig. 1–9). The stockholders appoint the board of directors at an annual meeting of the stockholders. In some small corporations, all the owners are on the board of directors. The directors meet regularly to decide the policies and major operating procedures of the company. Managing the day-to-day operation of the company is the responsibility of the president, who is named by the directors.

In a corporation, no person has unlimited liability. The owners can only lose the amount of money they invested in stock. The owners of a corporation are not responsible for the debts of the corporation. The corporation itself is the legal body and is responsible for its own debts. This protection against personal liability is one of the greatest advantages of a corporation. Of course, each person is personally responsible for obeying the law. The shield of a corporation cannot protect a dishonest person who breaks the law in an effort to falsely control the finances of even a large corporation.

Because there is no person who can be held accountable for the actions of the company, the government has stricter regulations for corporations than for the other forms of ownership. Also, corporations are more expensive to form and to operate than are proprietorships and partnerships.

## Building Codes

Most towns, cities, and counties have building codes. A building code is a set of regulations (usually in the form of a book) that ensure that all buildings in that jurisdiction (area covered by a certain government agency) are of safe construction. Building codes specify such things as minimum size and spacing of lumber for wall framing, steepness of stairs, and fire rating of critical components. The local building department enforces the local building codes. States usually have their own building codes, and state codes often require local building codes to be at least as strict as the state code. Most small cities and counties adopt the state code as their own, meaning that the state building code is the one enforced by the local building department.

Until recently there were three major model codes that were published by independent organizations. (A model code is a suggested building code that is intended to be adopted as is or with revisions to become a government's official code.)

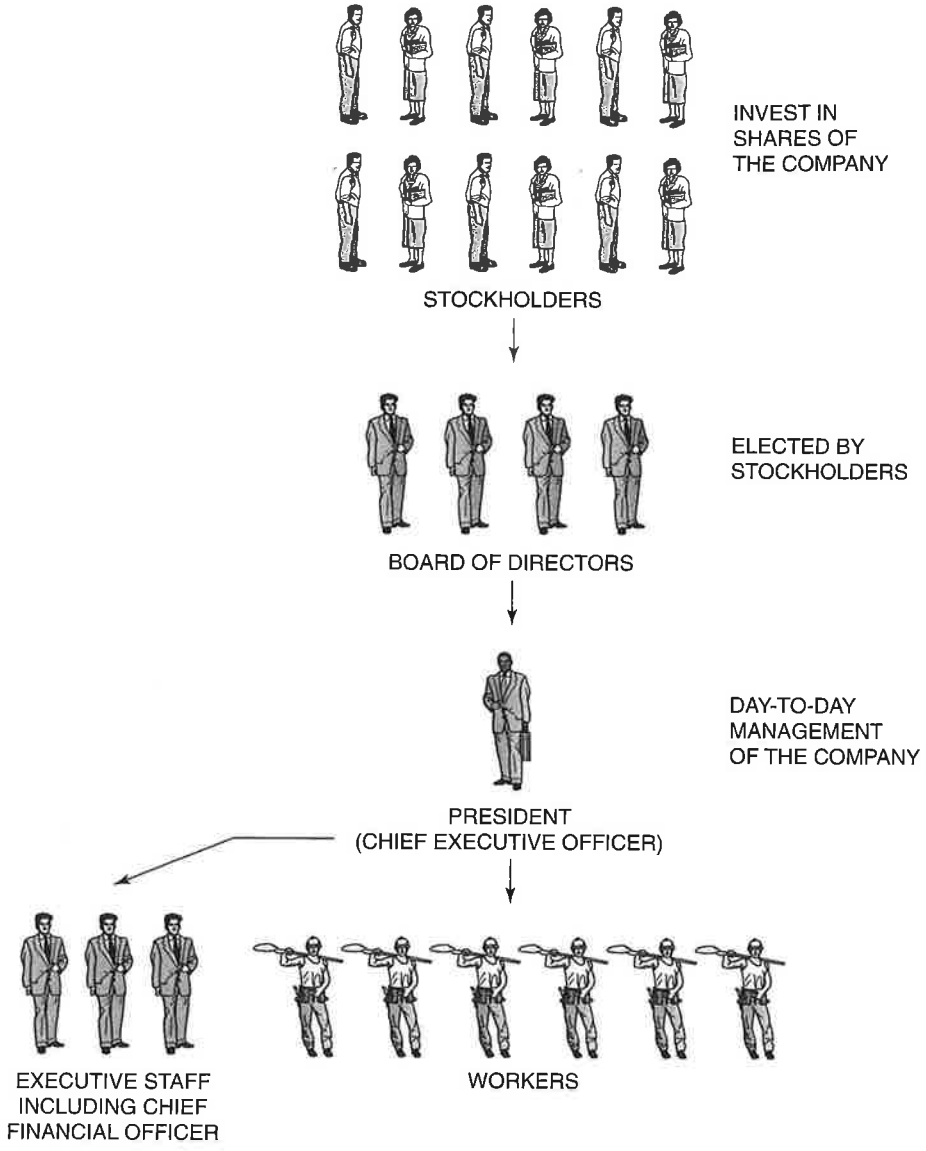



Figure 1–9 **Structure of a corporation.**

Each model code was widely used in a different region of the United States. By themselves model codes have no authority. They are simply a model that a government agency can choose to adopt as their own or modify as they see fit. In 2003 the International Code Council published a new model code called the *International Building Code* (Fig. 1–10). They also published the *International Residential Code* to cover home construction. Since publication of the first *International Building Code,* states have increasingly adopted it as their building code.

Other than the building code, there are many codes that govern the safe construction of buildings. There are plumbing codes, fire protection codes, and electrical codes. Most workers on the job site do not need to refer to the codes much during construction. It is the architects and engineers who design the buildings that usually see that the code requirements are covered by their designs. Plumbers and electricians do, however, need to refer to their respective codes frequently. Especially in residential construction, it is common for the plans to indicate where fixtures and outlets are to be located, but the plumbers and electricians must calculate loads and plan their work so it meets the requirements of their codes. The electrical and plumbing codes are updated frequently, so the workers in those trades spend a certain amount of their time just learning what is new in their codes.

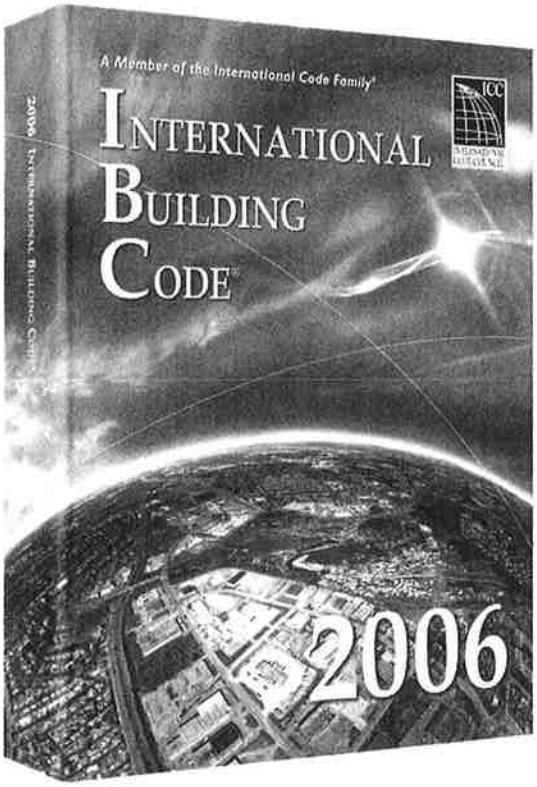



Figure 1–10 ***International Building Code,*** **courtesy of the International Code Council.**

## Unions and Contractors' Associations

In the construction industry, there are thousands of organizations of people with common interests and goals. Whole directories of these organizations are available in libraries and on the Internet. Two categories of construction organizations are of particular importance to construction students: craft unions and contractors' associations.

### Unions

A craft union, usually just called a "union," is an organization of workers in a particular building trade. Workers' unions were first formed in the 1800s when factory workers were being forced to work extreme hours under unsafe conditions—and for very low wages. Although working conditions in both factories and construction have improved dramatically, unions continue to serve a valuable role in the construction industry. Figure 1–11 lists several national construction craft unions.

Union members pay dues to be members of the union. Dues money pays for the benefits the union provides for its members. Most unions have an apprenticeship program that includes both classroom instruction and on-the-job supervised work experience. Some of the members' dues pay for instructors, classroom space, and training supplies. Unions usually provide a pension for members who have worked in the trade. Because they represent a large block of members, unions can be a powerful force in influencing government to do such things as pass worker safety laws, encourage more construction, and support technology that is good for construction. Unions negotiate with employers (contractors) to establish both a pay rate and working conditions for their members. It is quite typical to find that union members enjoy a higher hourly pay rate than nonunion workers in the same trade.

International Association of Bridge, Structural, Ornamental and Reinforcing Iron Workers (http://www.ironworkers.org/)

International Association of Heat and Frost Insulators and Asbestos Workers (http://www.insulators.org/)

International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers (http://www.boilermakers.org/)

International Brotherhood of Electrical Workers (http://www.ibew.org/)

International Brotherhood of Teamsters (http://www.teamster.org/)

International Union of Bricklayers and Allied Craftworkers (http://www.bacweb.org/)

International Union of Elevator Constructors (http://www.iuec.org/)

International Union of Operating Engineers (http://www.iuoe.org/)

International Union of Painters and Allied Trades (http://www.iupat.org/)

Laborers' International Union of North America (http://www.liuna.org/)

Operative Plasterers' and Cement Masons' International Association of the United States and Canada (http://www.opcmia.org/)

Sheet Metal Workers' International Association (http://www.smwia.org/)

United Association of Journeymen and Apprentices of the Plumbing and Pipefitting Industry of the United States and Canada (http://www.ua.org/)

United Brotherhood of Carpenters and Joiners of America (http://www.carpenters.org/)

United Union of Roofers, Waterproofers and Allied Workers (http://www.unionroofers.com/)

Utility Workers Union of America (http://www.uwua.org/)

Figure 1–11 **Construction craft unions.**

### Contractors' Associations

There are associations of contractors that include just about every imaginable type of construction contractor. Figure 1–12 lists only a small number of the largest associations

Air Conditioning Contractors of America (http://www.acca.org)

Air Conditioning and Refrigeration Institute (http://www.ari.org)

Associated Builders and Contractors (http://www.abc.org)

National Association of Home Builders (http://www.nahb.org)

Home Builder's Institute (http://www.hbi.org)

Independent Electrical Contractors Association (http://www.ieci.org)

National Electrical Contractors Association (http://www.necanet.org)

National Utility Contractors Association (http://www.nuca.com)

Plumbing-Heating-Cooling Contractors Association (http://www.phccweb.org)

The Associated General Contractors (AGC) of America (http://www.agc.org)

Figure 1-12 **These are only a few of the largest construction associations.**

that have apprenticeship programs. Some contractors' associations are formed to represent only nonunion contractors; a few represent only union contractors; and others represent both. Many associations of nonunion contractors were originally formed because the contractor members felt a need to work together to provide some of the benefits that union contractors receive—such as apprentice training and a lobbying voice in Washington, D.C.

## Review Questions

1. **Briefly describe the four levels of construction industry workers and give an example of each.**
2. **What are two ways of getting the training and developing the skills necessary to work in a building trade?**
3. **Where might you get the knowledge necessary to work as a surveyor?**
4. **Describe one job that might be done by an engineer in the home building industry.**
5. **What construction occupation is most apt to be concerned with the arrangement of rooms and the flow of traffic in a house?**
6. **Describe the relationship between general contractors and subcontractors.**
7. **Whose seal must appear on the drawings before work can begin on a house?**
8. **Briefly describe each of the following forms of business ownership:**

   Sole proprietorship
   Limited liability partnership
   Corporation

9. **In which form of ownership is the risk the greatest?**
10. **What is the advantage of a corporation to the business owner?**
11. **Which of the following might be covered by a building code?**

    a. minimum size of floor framing materials
    b. type of building allowed in a certain area
    c. distance from road or street to front of building
    d. all of the above

12. **Which trade does work that is commonly covered by a code?**

    a. electricians
    b. carpenters
    c. plumbers
    d. all of the above

13. **List three things a union does for its members.**
14. **List three places one might go for training in a building trade.**